

## DTC P2200, P2202, P2203, P229E, P22A0, or P22A1

### Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

### DTC Descriptors

#### **DTC P2200**

NOx Sensor 1 Circuit

#### **DTC P229E**

NOx Sensor 2 Circuit

#### **DTC P2202**

NOx Sensor 1 Circuit Low Voltage

#### **DTC P2203**

NOx Sensor 1 Circuit High Voltage

#### **DTC P22A0**

NOx Sensor 2 Circuit Low Voltage

#### **DTC P22A1**

NOx Sensor 2 Circuit High Voltage

### Diagnostic Fault Information

| Circuit                          | Short to Ground                     | Open/High Resistance | Short to Voltage                    | Signal Performance |
|----------------------------------|-------------------------------------|----------------------|-------------------------------------|--------------------|
| NOx Sensor Ignition Voltage      | U029D,<br>U029E,<br>P220A,<br>P220B | U029D,<br>U029E      | U029D,<br>U029E,<br>P220A,<br>P220B | —                  |
| High Speed GMLAN Serial Data (+) | U0074,<br>P205D                     | U010E,<br>P205D      | U0074,<br>P205D                     | —                  |
| High Speed GMLAN Serial Data (–) | U029D,<br>U029E,<br>U010E,<br>P205D | U010E,<br>P205D      | U010E,<br>P205D                     | —                  |
| NOx Sensor Ground                | —                                   | U029D,<br>U029E      | —                                   | —                  |

© 2014 General Motors. All rights reserved.

### Circuit/System Description

The reductant system uses two nitrogen oxide (NOx) sensors to monitor the amount of NOx in the engine's exhaust gas. The first sensor is located at the outlet of the turbocharger and monitors the engine out NOx level. The second NOx sensor is located between the selective catalytic reduction (SCR) and the diesel particulate filter (DPF) and monitors NOx levels downstream of the SCR. The second NOx sensor also provides the engine control module (ECM) with information on the exhaust oxygen level during DPF regeneration.

Each NOx sensor contains a sensing cell, a pumping cell, and a heater. A sample of exhaust gas passes through a diffusion gap between the sensing cell and the pumping cell. The NOx sensor maintains a constant reference voltage across the sensing cell. An electronic circuit within sensor controls the pump current through the pumping cell in order to maintain a constant voltage in the sensing cell. The amount of current required to maintain the reference voltage in the sensing cell is proportional to the concentration of NOx in the exhaust.

The ECM varies the amount of diesel exhaust fluid (DEF) or reductant added by varying the reductant injector duty cycle in response to changes in engine exhaust out NOx levels.

The smart NOx sensors consist of two components, the NOx module and the NOx sensor element that are serviced as a unit. A circuit or performance condition with a NOx sensor is detected by the NOx sensor module. The smart NOx sensor module communicates the condition to the ECM over the serial data line. The ECM sets a DTC when a serial data message is received from the NOx sensor module.

### Conditions for Running the DTCs

#### **P2200**

- DTCs P2205, P2209, P22A3, or P22A7 are not set.
- The battery voltage is greater than 11 V.
- The engine speed is greater than 600 RPM.
- The engine run time is greater than 20 s.
- The exhaust gas temperature Sensor 1 is greater than 95°C (203°F).
- The NOx sensor is at operating temperature.
- The DTCs run continuously once the above conditions are met.

#### **P2202, P2203, P22A0, and P22A1**

- DTCs P2205, P2209, P22A3, or P22A7 are not set.
- The battery voltage is greater than 11 V.
- The engine speed is greater than 600 RPM.
- The engine run time is greater than 20 s.
- The exhaust gas temperature Sensor 1 is greater than 95°C (203°F).
- The NOx sensor is at operating temperature for greater than 10 minutes.
- The DTCs run continuously once the above conditions are met.

#### **P229E**

- DTCs P2205, P2209, P22A3, or P22A7 are not set.
- The battery voltage is greater than 11 V.
- The engine speed is greater than 600 RPM.
- The engine run time is greater than 20 s.
- The exhaust gas temperature sensor 3 is greater than 95°C (203°F).

- The NOx sensor is at operating temperature.
- The DTCs run continuously once the above conditions are met.

### Conditions for Setting the DTC

#### **P2200 or P229E**

The ECM receives a NOx sensor module serial data message indicating an open signal circuit for greater than 3 s.

#### **DTC P2202 or P22A0**

The ECM receives NOx sensor module serial data message indicating a NOx concentration is less than -90 ppm for greater than 3 s.

#### **DTC P2203 or P22A1**

The ECM receives NOx sensor module serial data message indicating a NOx concentration is greater than 2500 ppm for greater than 3 s.

### Action Taken When the DTC Sets

- DTCs P2200, P2202, P2203, P229E, P22A0, and P22A1 are Type B DTCs.
- The ECM commands the engine to operate in Reduced Engine Power mode.
- The driver information center may display the Engine Power Is Reduced message.

### Conditions for Clearing the DTC

DTCs P2200, P2202, P2203, P229E, P22A0, and P22A1 are Type B DTCs.

### Reference Information

#### **Schematic Reference**

Engine Controls Schematics

#### **Connector End View Reference**

Component Connector End Views

#### **Electrical Information Reference**

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

#### **DTC Type Reference**

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

#### **Scan Tool Reference**

Control Module References for scan tool information

### Circuit/System Verification

1. Ignition ON, observe the DTC information with a scan tool. DTC UXXXX should not be set.  
⇒ If a DTC is set, refer to Diagnostic Trouble Code (DTC) List - Vehicle for further diagnosis.
2. Verify the following conditions do not exist with the exhaust system:

- Leaks — Refer to [Exhaust Leakage](#)
- Physical damage
- Loose or missing hardware
- Loose B195 NOx sensors or B131 exhaust temperature sensors

⇒ If a condition is found, repair the exhaust system.

3. If the exhaust system tests normal, replace the B195 NOx sensor.
4. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

### **Repair Instructions**

- [Nitrogen Oxide Sensor Replacement - Position 1](#)
- [Nitrogen Oxide Sensor Replacement - Position 2](#)
- Perform the scan tool NOx Sensor 1 or 2 Reset procedure after replacing the NOx sensor 1 or 2.

### **Repair Verification**

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming, or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Ignition OFF, all vehicle systems OFF, this may take up to 2 minutes.
5. In order to clear the DEF lamp, perform the [Reductant Fluid Quality Test](#). The DEF lamp should turn OFF once the test is finished.  
⇒ If the DEF lamp does not turn OFF, a condition with the system still exists.